

Health impact of contextual socioeconomic conditions: different levels of association according to aggregate socioeconomic indicators, modelling strategies and ecological level.

*Impatto Sanitario delle Condizioni Socioeconomiche del Contesto:
Differenti Livelli di Associazione al Variare degli Indicatori
Socioeconomici Aggregati, delle Strategie di Modellizzazione e della
Granularità Geografica*

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Riassunto

Analizzando la mortalità e la morbosità, in Italia, in funzione degli indici comunali di deprivazione socioeconomica, il grado di tali associazioni sembra trascurabile. Il gradiente Nord-Sud nella salute soggettiva sembra maggiormente legato alla composizione delle ripartizioni in base alle circostanze socioeconomiche individuali, solo lievemente influenzato dai contesti, che tuttavia modificano gli svantaggi di salute individuali associati a scarsa istruzione. Le condizioni socioeconomiche individuali e del contesto mostrano invece un effetto indipendente e significativo sulla mortalità dei torinesi per alcune specifiche cause. Il paper mira a fornire una sintesi degli studi empirici condotti in Italia sull'effetto del contesto, concentrandosi sulle criticità metodologiche per fornire spiegazioni sulle fonti di eterogeneità dei risultati osservati.

keywords: social deprivation, health geography

1. Introduction

Analysis of geographical and social inequalities in mortality and morbidity allows to focus on potentials for gaining health by specific population subgroups. However what proportion of the geographic inequalities is explained by social inequalities? And what matters more with regard to health inequalities, the social characteristics of the individual or the social characteristics of the area? Policies and interventions aiming to tackle health inequalities among individuals may be different from the ones addressing inequalities among areas. In the epidemiologic literature these two explanatory mechanisms for health inequalities are called compositional effect and contextual effect (0). The research interests and contributions from scientific community, on the particular concern of the relative role of these two effects have been fuelled by the new

multilevel methods in statistical modelling, but have been mostly driven by data availability, with poor conceptualisation of the meaning of the social characteristics under study, and within the frame of an idle dispute between psychosocial vs. neo-materialistic explanations of the effect of income inequalities on health (0, 0, 0). The present Italian work in progress on health inequalities is confronting the research questions and limitations described above.

2. The empirical contributions

The paper will provide a brief review of the Italian scientific contributions on the concern of geographical inequalities in health, particularly those responding to the purposes of: 1) highlighting significance and magnitude of socioeconomic determinants of health differences; 2) providing empirical elements supporting health and non-health policies towards actions aimed at tackling differences in health needs; 3) providing empirical support for health service resources allocation based on needs. The health information on which they have been based include mortality, self reported health or morbidity, and health care utilization data. The available information on socioeconomic attributes include individual information in few local longitudinal studies, connected to mortality or morbidity data, or from the National Health Interview Survey, otherwise aggregate indicators at census tract, municipality, or province level were connected to health indicators.

2.1 Mortality at national level

The geographical distribution of mortality, over the 1990-1992 period, across Italian municipalities shows unfavourable profiles in mountain municipalities and Southern big cities (0). In the last decades even life expectancy has improved faster in the North compared to the South, despite the persistent Southern protection against the cancer risk (0). Two studies have provided evidence on the contribution of social inequalities on mortality differentials.

Municipality (more than 8100 municipalities) aggregate socioeconomic deprivation (sum of z-score of indicators of disadvantage on education, occupation, class, housing and family support) seems mostly characterizing Southern and highland municipalities (0). However, when analysing mortality as a function of municipality deprivation within young adults during the 1995-97 the observed association seems to be negligible, with no more than 10% mortality excess among residents within more deprived municipalities, compared to residents in richer areas. As for specific causes of death in both genders, the observed trend in mortality risks by deprivation level is not regular, particularly in diseases known to be associated with socioeconomic position (0). Overall mortality differences by municipality deprivation seem to have a weaker and less regular association than the observed mortality trend by individual socioeconomic attributes, as it was measured, for example, within the Turin Longitudinal Study (0). The impact of deprivation may be truly small or the measure of deprivation may be too inaccurate or the municipality aggregation may be inadequate to provide good approximation of the health effect of deprivation.

At the Italian province level (95 provinces), 1995 median per capita income and its concentration showed to be inversely correlated, with Southern residents being poorer

on province average and characterized by higher area income inequalities. Higher mortality seems to be observable with increasing per capita income among males and with decreasing income among females, while the reversed associations are shown between mortality and income concentration, significant only among females. Mortality seems to increase as Gini concentration index increases among residents, especially female, in poorer provinces; moreover elderly females residents in Southern regions report higher mortality risk according to increasing income concentration, controlling for median income and age (0). In this study, the description of areas from the only point of view of economic resources ensures higher content validity of the aggregate indicator, the areas of interest are also quite homogenous; results highlight interesting direct associations between mortality risk and income concentration of small size, modified by per capita income, gender, age and macro-region.

2.2 Self reported health at national level

Geographical distribution of self-reported health status across Italian regions, according to the National Health Interview Survey performed in the year 2000, shows a clear North-South gradient, with better conditions in the Northern regions, for both males and females. Regional standardized prevalences of self perceived poor health, of severe chronic morbidity referred as diagnosed by a physician and of disability highlight a geographical gradient, characterized by higher figures in the Central and particularly in the Southern regions compared with Northern areas. As observed for mortality, even in self reported health the descriptive analyses show a capability of predicting health that is weaker in the case of composite deprivation indices at the municipality level, compared to the individual level information, consistently among both genders.

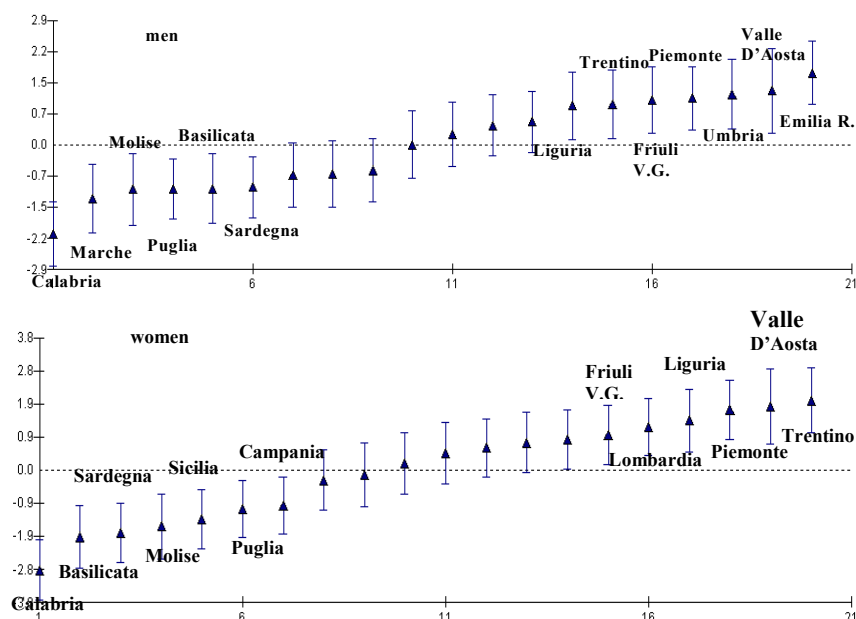
Results from multilevel models suggest that the Italian North-South gradient in health is mainly affected by macro-area compositional differences in individual socio-economic circumstances, mainly education, with no influence of municipality socioeconomic deprivation (0). For instance, regional distribution of the SF12 scale standardized scores confirm poorer subjective physical health in the Central and particularly in the Southern regions compared with Northern areas, strongly influenced by macro-area compositional differences in a plurality of measures of socioeconomic conditions (table1). However, being less educated leads to poorer health in some regions (mainly the South) than in others (mainly the Northeast). A significant contextual effect seems to be related to the regional modification of the health impact of the individual socioeconomic disadvantage (figure 1) and similar results are observed for SF12 mental component summary.

Table 1. *SF12-Physical component summary. Linear regression coefficients and 95% CI from multilevel models*, people aged 18-80yrs*

		Men		Women	
		Coeff.	95%CI	Coeff.	95%CI
Education (ref.degree)	Diploma	-0.9	(-1.2; 0.6)	-0.7	(-1.0;-0.4)
	Lower secondary	-1.5	(-1.8; 1.2)	-1.6	(-1.9;-1.3)
	Primary	-3.9	(-4.4; 3.3)	-4.9	(-5.6;-4.2)
occupational status and position (ref. non manual)	Unemployed	-2.4	(-2.6; 2.2)	-1.2	(-1.4;-1.0)
	Housewives			-0.3	(-0.5;-0.1)
	Manual	-0.1	(-0.2; 0.1)	0.0	(-0.3; 0.2)
family type (ref. couples with children/other)	lone parents./alone	0.3	(0.1; 0.5)	-0.3	(-0.5;-0.1)
	other/couples	-0.3	(-0.5; 0.2)	-0.9	(-1.1;-0.8)
house conditions (ref. other/ownership)	no toilet or small with one toilet/rented	-0.4	(-0.5; 0.2)	-0.4	(-0.6;-0.2)
demographic size and altitude (ref. 10,001-5,0000 inhab)	Metropolitan area	0.3	(0.0; 0.7)	-0.1	(-0.6; 0.3)
	<=2,000 inhab. Lowland	-0.5	(-0.8; 0.1)	-0.6	(-1.0;-0.1)
	<=2,000 inhab.mountain	-0.2	(-0.5; 0.1)	0.0	(-0.3; 0.4)
	2,001-10,000 inhab. lowland	-0.1	(-0.5; 0.2)	-0.2	(-0.5; 0.2)
	2,001-10,000 inhab. Mountain	0.0	(-0.4; 0.3)	-0.1	(-0.4; 0.3)
	>50,000 inhab.	0.3	(0.0; 0.7)	0.1	(-0.3; 0.5)
geographical area (ref. north)	Centre	-0.1	(-0.6; 0.3)	0.1	(-0.3; 0.6)
	South	-0.3	(-0.6; 0.1)	-0.1	(-0.5; 0.2)
	Isles	-0.3	(-0.8; 0.3)	-0.6	(-1.1-0.1)

*including also age

Figure 1. *Regional significant residuals of SF12-physical component summary differences: primary vs. degree*



2.3 Health care utilization at national level

As for health care, data collected from the same survey were used to develop a summary index of health services utilization (0) and to analyse it as a function of individual socioeconomic conditions and contextual features, besides chronic morbidity and age. When all these variables are controlled for, the indicators of social disadvantage are no more predictive, with the exception of a higher services consumption among unemployed vs. non manual workers, and a significantly lower utilization among residents in very small municipalities, in both males and females, with no significant geographical differences and no regional modifications in the effect of individual social disadvantage (table 2). Instead, in absence of direct health needs information, age and socioeconomic conditions, besides presence of geographical distance to offer, seem to be the most predictive indirect indicators of needs and then the necessary information for appropriate health services allocation formulae.

2.4 Mortality at local level

Important pieces of information concerning health and context have been provided by local studies.

General mortality rates (standardised by age and gender) for all causes of death in Turin's 23 neighbourhoods, for the last three decades of 1900, tended to be higher in the central and northern areas. This distribution is very similar to that of the deprivation indices respectively in 1971, 1981 and 1991, with the poorer neighbourhoods located in northern and central Turin and in the city's southernmost point. Individual and contextual socioeconomic conditions showed an independent and significant impact on mortality (two to three times larger for individual than for contextual variables), both among males and females. The contribution of contextual deprivation was significantly higher for coronary heart and respiratory death causes among people, aged less than 65 years (9% and 15% excess for coronary heart diseases, 20% and 24% for respiratory diseases, respectively for males and females living in deprived neighbourhoods vs. rich). Negligible mortality differences by neighbourhood deprivation are observed among elderly (0). However the observed health impact of contextual deprivation seemed to be modest, particularly when compared to neighbourhood unemployment among different European big cities (0). Local studies highlight significant mortality excesses influenced by both individual and contextual deprivation, even though area effect seems to be slightly predictive when controlling for individual socioeconomic disadvantage. A multilevel analysis of mortality in Turin as a function of both census tract median income and neighbourhood Gini income concentration, controlling for age and education, highlighted a significantly higher risk of death among residents in neighbourhoods with higher income inequalities only when small area income and individual education are controlled for, particularly among men (table 3).

Table 2. Use of health services. National health interview survey 1999-2000, multilevel models on a composite utilization index among users.

		males			females				
		coeff	IC95%	coeff	IC95%	coeff	IC95%		
chronic morbidity index (rif. no morbidity)	II			1.24	(1,18;1,3)		1.09	(1,03;1,15)	
	III			1.92	(1,84;1,99)		1.78	(1,71;1,85)	
	IV			3.04	(2,98;3,11)		2.73	(2,67;2,79)	
age (ref. 18-30)	31-64	0.77	(0,71;0,83)	0.26	(0,21;0,32)	0.49	(0,43;0,55)	0.03	(-0,03;0,09)
	65-74	1.74	(1,64;1,84)	0.72	(0,63;0,82)	1.25	(1,16;1,35)	0.31	(0,22;0,4)
	75+	2.14	(2;2,28)	0.87	(0,74;1)	1.69	(1,58;1,81)	0.58	(0,47;0,69)
education (ref. degree)	diploma	0.15	(0,05;0,25)	0.09	(0;0,18)	0.06	(-0,04;0,16)	-0.02	(-0,11;0,07)
	lower secondary	0.12	(0,02;0,22)	0.04	(-0,06;0,13)	-0.05	(-0,16;0,05)	-0.20	(-0,29;-0,1)
	primary	0.30	(0,19;0,41)	-0.04	(-0,14;0,06)	0.29	(0,16;0,43)	-0.21	(-0,33;-0,1)
house conditions (ref. other types/ownership)	small house/1 toilet	0.07	(0;0,14)	0.06	(-0,01;0,12)	0.07	(0,01;0,14)	0.05	(-0,01;0,11)
	lone parent/alone	-0.07	(-0,16;0,03)	0.00	(-0,08;0,09)	0.27	(0,2;0,34)	0.14	(0,08;0,21)
	other/couples	0.19	(0,13;0,25)	0.12	(0,07;0,17)	0.34	(0,28;0,39)	0.19	(0,14;0,24)
occupational status and position (ref. non manual)	unemployed	0.52	(0,43;0,62)	0.16	(0,07;0,25)	0.29	(0,22;0,35)	0.08	(0,02;0,14)
	manual	0.02	(-0,05;0,08)	0.04	(-0,02;0,1)	0.10	(0,03;0,16)	0.05	(-0,01;0,11)
	housewives					0.00	(-0,09;0,08)	0.01	(-0,07;0,08)
demographic size and altitude (ref.metropolitan areas)	<= 2000 inhab. lowland	-0.21	(-0,4;-0,02)	-0.23	(-0,4;-0,07)	-0.16	(-0,35;0,03)	-0.20	(-0,36;-0,04)
	<= 2000 inhab. mountain	-0.28	(-0,45;-0,11)	-0.25	(-0,39;-0,1)	-0.22	(-0,39;-0,05)	-0.21	(-0,36;-0,07)
	2001-10000 inhab. lowland	-0.06	(-0,22;0,11)	-0.11	(-0,25;0,04)	-0.12	(-0,29;0,05)	-0.16	(-0,3;-0,01)
	2001-10000 inhab. mountain	-0.14	(-0,31;0,03)	-0.12	(-0,27;0,02)	-0.13	(-0,3;0,04)	-0.15	(-0,29;0)
	10001-50000 inhab.	-0.05	(-0,22;0,13)	-0.06	(-0,2;0,09)	-0.16	(-0,34;0,01)	-0.18	(-0,33;-0,03)
	> 50000 inhab.	-0.09	(-0,29;0,11)	-0.06	(-0,23;0,11)	-0.18	(-0,38;0,02)	-0.19	(-0,36;-0,03)
geographical area (ref. north)	centre	-0.03	(-0,25;0,2)	-0.08	(-0,24;0,09)	0.16	(-0,04;0,36)	0.04	(-0,1;0,17)
	south	-0.22	(-0,42;-0,03)	-0.21	(-0,35;-0,07)	0.16	(-0,01;0,32)	-0.03	(-0,14;0,08)
	isles	-0.26	(-0,54;0,02)	-0.22	(-0,42;-0,02)	0.27	(0,03;0,51)	0.04	(-0,11;0,2)

Table 3. *General mortality 1998-2005 and socioeconomic circumstances in 1998; Turin residents, aged 15-64, multilevel models.*

Males

Neighbourhood Gini index			
quintile 5	0.89 (0.78, 1.03)	1.09 (0.99, 1.20)	1.17 (1.07, 1.29)
quintile 4	0.92 (0.79, 1.06)	1.01 (0.92, 1.11)	1.05 (0.96, 1.15)
quintile 3	0.87 (0.76, 1.00)	0.96 (0.88, 1.05)	0.98 (0.90, 1.07)
quintile 2	0.90 (0.77, 1.05)	1.01 (0.92, 1.12)	1.02 (0.93, 1.13)
quintile 1	1.0	1.0	1.0
Census tract median income			
quintile 5		0.56 (0.52, 0.60)	0.69 (0.63, 0.75)
quintile 4		0.64 (0.60, 0.69)	0.71 (0.66, 0.77)
quintile 3		0.75 (0.70, 0.81)	0.80 (0.74, 0.86)
quintile 2		0.83 (0.78, 0.89)	0.86 (0.80, 0.93)
quintile 1		1.0	1.0
Education			
primary or less			1.68 (1.57, 1.81)
lower secondary			1.47 (1.37, 1.57)
diploma or higher			1.0

Females

Neighbourhood Gini index			
quintile 5	0.96 (0.84, 1.09)	1.10 (0.98, 1.22)	1.13 (1.01, 1.26)
quintile 4	0.96 (0.85, 1.09)	1.03 (0.94, 1.14)	1.05 (0.95, 1.16)
quintile 3	0.99 (0.88, 1.12)	1.06 (0.97, 1.16)	1.07 (0.97, 1.17)
quintile 2	0.95 (0.83, 1.10)	1.03 (0.92, 1.14)	1.03 (0.93, 1.15)
quintile 1	1.0	1.0	1.0
Census tract median income			
quintile 5		0.68 (0.62, 0.74)	0.71 (0.64, 0.79)
quintile 4		0.79 (0.72, 0.86)	0.81 (0.73, 0.89)
quintile 3		0.80 (0.73, 0.87)	0.81 (0.74, 0.89)
quintile 2		0.85 (0.78, 0.93)	0.86 (0.78, 0.94)
quintile 1		1.0	1.0
Education			
primary or less			1.19 (1.09, 1.30)
lower secondary			1.10 (1.01, 1.20)
diploma or higher			1.0

2.5 Methodological caveats

The evidence described above tried to measure the health impact of socioeconomic disadvantage with the available data through: i) ecological studies, with aggregate deprivation as a proxy for individual circumstances (municipality deprivation and mortality), or used as both proxy and contextual information (median and Gini income at the province level); ii) individual studies, with aggregate deprivation at the municipality (national studies on self reported health) or neighbourhood level (local studies on mortality), only used to evaluate health impact of contextual socioeconomic conditions. Common findings concern the main impact of individual socioeconomic conditions, underestimated by aggregate deprivation when used as a proxy, and the weak effect of aggregate contextual deprivation, direct or as a modifier of individual socioeconomic disadvantage.

Methodological caveats of the empirical studies can be classified according to four domains: the indicator, the ecological bias, the modelling and the explanatory framework.

2.6 The indicator

Relationship between mortality and municipality composite deprivation index has shown to be weak and irregular: the content validity of the composite indicator, and of its components, could vary across regions. Its predictive capability could be significant after a latency period, as it was observed for lung cancer mortality in Tuscany municipalities (0).

2.7 Ecological bias

Analysis of mortality risk as a function of area socioeconomic deprivation has shown weaker associations when size of areas increases (0), but a potential impact of dimensional heterogeneity of areas could also be hypothesized. A specific investigation of the effect of aggregation in Turin areas was performed, simulating 4 different hypothetical composition of the city population on the basis of different degree of dimensional heterogeneity of areas: general hospitalisation rate has shown to be largely heterogeneously associated with aggregate deprivation according to dimensional heterogeneity of areas. (0).

2.8 Modelling

Modelling individual health data as a function of individual and aggregate deprivation has shown to underestimate contextual effect, unless multi-level Chronbach's formulation is the modelling approach (0). Modelling aggregate mortality data adjusted by age as a function of aggregate deprivation unadjusted by age may introduce bias.

2.9 Explanatory framework

Despite growing body of empirical literature, the contextual effect of area deprivation on health is still poorly conceptualized and a clear definition of deprivation has not yet provided. Following works by Diderichsen, Wilkinson, Navarro and Macintyre, the role of upstream contextual factors on health, through individual and contextual socioeconomic determinants, was explored to explain the observed impact of the Southern context on worsening self reported health among the poorly educated (figure 1). Figure 2 shows the theoretical pathways underlining socioeconomic inequalities in health. The left side of the figure illustrates macro-level distal policy dimensions; the interaction between national, regional or local policies and characteristics of historical social sub-systems is intended to directly influence the availability and the distribution of socioeconomic resources and also their capacity to buffer needs, acting at both the individual and contextual level. The remaining right side of the conceptual scheme represents known proximal mediating mechanisms influencing magnitude of socioeconomic inequalities in health. For each macro-level distal dimension in the conceptual framework for heterogeneity of inequalities, figure 3 shows the significant regional indicators (out of 17 indicators admitted to test) with the largest reduction in regional heterogeneity of health inequalities between the most and least educated people, as it was measured through the 2000 National Health Interview Survey. Among men, the Welfare regional indicator *prompt access to breast screening* produced the largest reduction in regional heterogeneity of physical health inequalities, followed by

the Economy dimension, measured by *per capita income*; however, the Labour market *rate of first employment within 3 years, among graduated people*, was also highly predictive of regional variation of inequalities; Labour dimension expressed by the *total unemployment rate* seems to provide the highest contribution for the reduction of mental health inequalities, followed by *per capita income*. Social cohesion made the smallest contribution, although it was not negligible in explaining the variation in mental health inequalities. With regard to women, the largest contribution toward explaining physical health inequalities was provided by *per capita income*, followed by Labour (*total unemployment rate*) and Welfare (*prompt access to breast cancer screening*); Social Cohesion made the smallest contribution. Labour market made the largest contribution in the reduction of mental health inequalities by education, and the smallest was provided by *prompt access to breast cancer screening*. The result suggest that the Southern incapacity to buffer the impact of individual disadvantage on health may be attributed to the geographical inequalities in the amount of resources that Economy and Labour produce and distribute, and in the quality of services and help that Welfare and Social Cohesion provide in order to buffer the impact of individual disadvantage.

Figure 3. *Conceptual framework of dimensions involved in regional heterogeneity of socioeconomic inequalities in health*

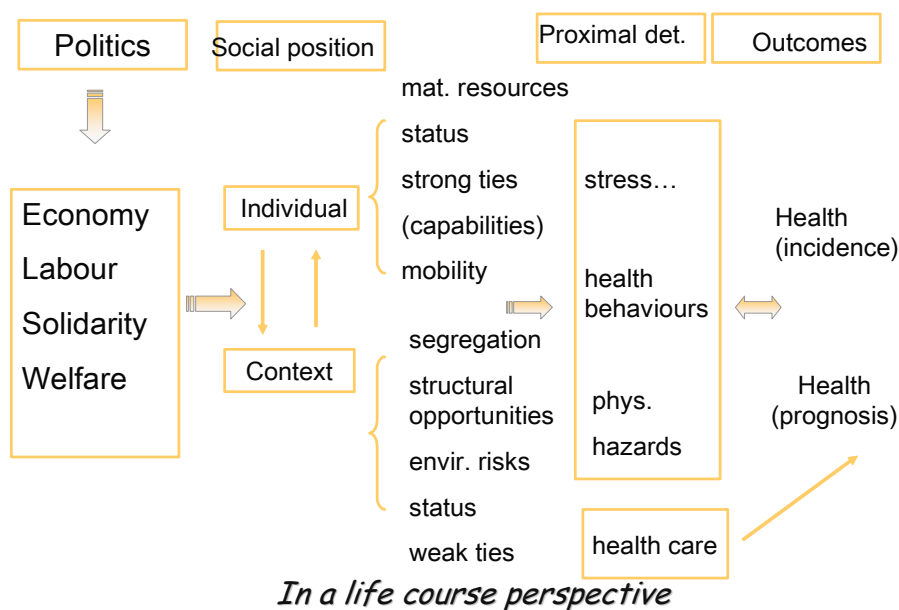
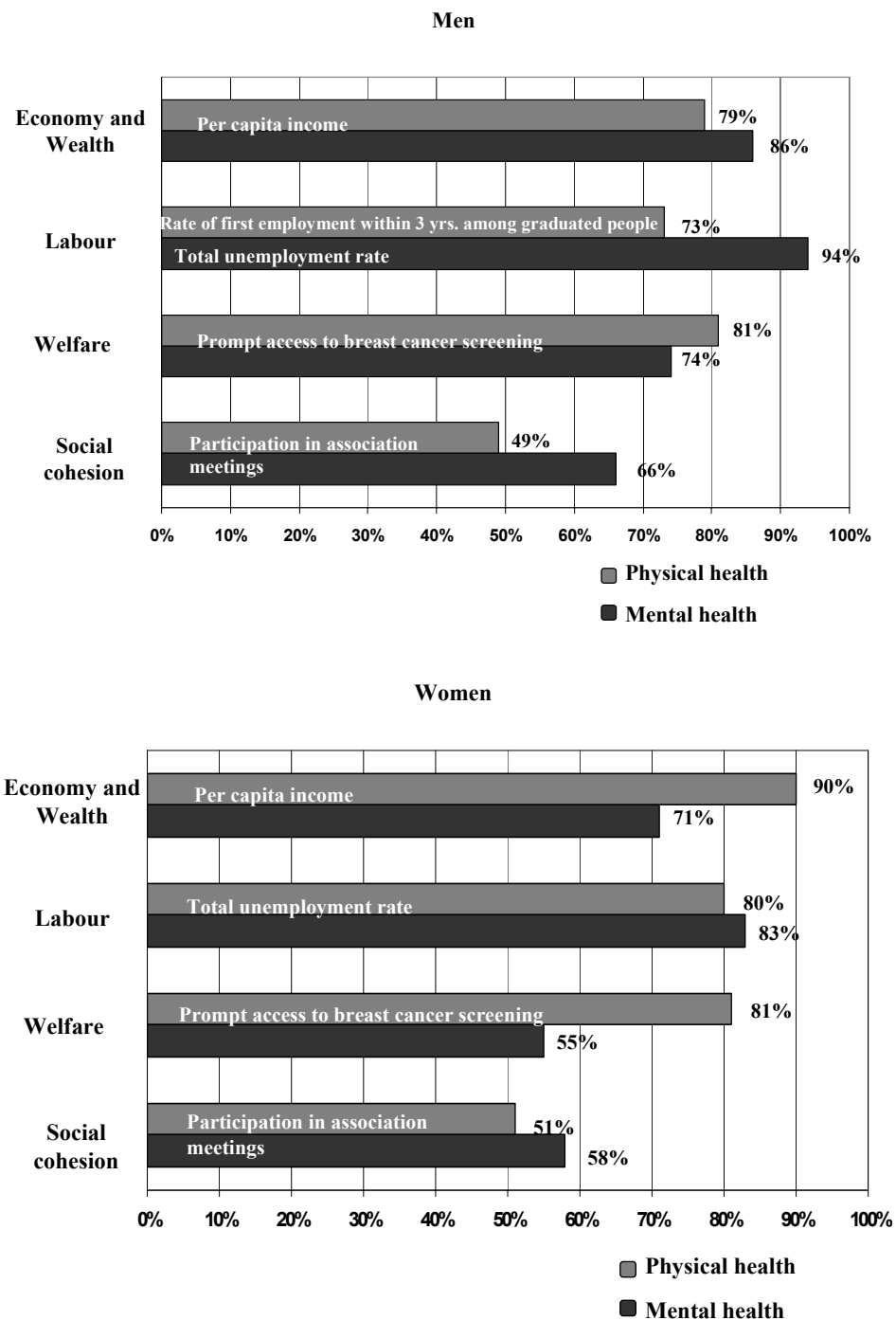


Figure 4. Significant regional indicators with the largest reduction of regional heterogeneity in health inequalities between most and least educated people, and corresponding reduction (%)



3. Conclusions

In the Italian research interest, as in the International context, focus on place effect on health is largely driven by data and methodology availability. Literature includes few examples aimed at testing explicit hypothesis on specific mechanisms underlining health impact of context, with appropriate specification of outcomes, population, time and space scale of effects. Much empirical documentation includes examples of inappropriate confounding control or poor specification of mediating attributes affecting health and place associations. Features of place potentially influencing health have been poorly conceptualized and far from being operationalised and evaluated (0).

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